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CAECIDOTEA PHREATICA, A NEW PHREATOBITIC ISOPOD CRUSTACEAN (ASELLIDAE) FROM SOUTHEASTERN VIRGINIA

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Abstract.—*Caecidotea phreatica* is described from groundwater outlets (drains, wells, and a seep) on the Coastal Plain of southeastern Virginia. It is assigned to the Hobbsi Group and is the first stygobiont isopod found in Virginia outside of karst areas in the western part of the state. The natural habitat of this species is believed to be interstitial.

The species described below is the first subterranean isopod to be found in Virginia distant from karst areas in the Appalachian Valley and Ridge Province in the western part of the state. Virginia has the distinction of containing more species of subterranean asellid isopods than any other state due to the presence of the diverse fauna of the Cannulus Group (Steeves 1963; Lewis 1980), and to a lesser extent, the Stygia Group (Steeves 1963). In addition to the species of *Caecidotea,* the only known troglobitic species of *Lirceus* are endemic to caves in Virginia (Holsinger and Bowman 1973; Estes and Holsinger 1976). Of this assemblage of subterranean species, it is difficult to differentiate between obligate troglobites and phreatobites, inasmuch as some species [e.g., *C. bowmani* (Lewis 1980)] are found in seeps or drain tiles where phreatobites would be expected, but caves are also found nearby. In contrast, *Caecidotea phreatica* is clearly an obligate phreatobite, known only from the Coastal plain near the mouth of Chesapeake Bay. Although most of the known phreatobitic *Caecidotea* occur in glacial deposits in the central United States (see Lewis and Bowman 1981; Lewis 1982), a few species are also known from Coastal Plain habitats similar to that of *C. phreatica*: *C. hobbsi* from crayfish burrows in Florida (Steeves 1966); *C. paurotrigonus* from a drain tile in Mississippi (Fleming 1972); and *C. beattyi* from a drain tile in southern Illinois (Lewis and Bowman 1981).

As pointed out previously (Lewis 1982), the ecological forte of the species of the Hobbsi Group (to which the new species is assigned) has been their colonization of phreatic habitats. The majority of phreatobites that occur outside of cave areas belong to the Hobbsi Group, although within the Stygia Group, *C. beattyi* is clearly a phreatobitic offshoot of the closely related troglobite *C. antricola* that occurs in the Ozarks adjacent to the range of this species.

The troglobitic fauna of the eastern United States is probably relatively well known at this point due to the intensive biological exploration of caves during the past two decades. However, the phreatobitic fauna probably remains poorly known, due both to the lag in collecting from subterranean habitats other than caves and the difficulty in finding ways of collecting from phreatic habitats. Whereas caves offer relatively easy access to troglobitic species, collecting phreatobites is contingent on the often ephemeral presence of isopods in drain tiles and adjacent ditches, seepage areas, wells, or cisterns. Additional undescribed species probably remain to be found in habitats on the Coastal Plain as well as elsewhere.

Caecidotea phreatica, new species
Figs. 1–3

Material examined.—VIRGINIA. Isle of Wight Co.: basin fed by drain pipe (#1) on Taylor farm, 5.6 km N of Chuckatuck, 3 ♂♂, 5 ♀♀, J. R. Holsinger, 27 Mar 1983; basin fed by drain pipe (#2) on Taylor farm, 18 ♂♂, 34 ♀♀, J. R. Holsinger, 24 Apr 1983.—Nansemond Co.: outlet of drain tile at bottom of access well on Barlow farm, 3.2 km NNE of Chuckatuck, 2 ♂♂, 2 ♀♀, J. R. Holsinger and R. B. Godfrey, 26–27 Mar 1983; shallow well (#1) on Barlow farm, 5 ♂♂, 8 ♀♀, J. R. Holsinger and R. B. Godfrey, 26 Mar 1983; shallow well (#2) on Barlow farm, 1 fragment, J. R. Holsinger, 27 Mar 1983; outlet of drain, 4.8 km NW of Suffolk, 20 ♂♂, 33 ♀♀, Leslie Hubricht, 25 Feb 1945; seep-fed pool in woods, 4.8 km NW of Suffolk and 0.5 km W of Murphy's Pond, 10 ♂♂, 7 ♀♀, J. R. Holsinger, 25 Mar 1984.

A 9.5 mm ♂ from the Holsinger collection of 25 March 1984 is designated as the holotype (USNM 227038); the remaining specimens are paratypes. All of the material examined has been deposited in the National Museum of Natural History (Smithsonian Institution) under catalog numbers of the former United States National Museum (USNM).

Description.—Eyeless, unpigmented. Longest ♂ about 9.5 mm, ♀ 7.5 mm; body slender, about 7× as long as wide. Head about 1.4× as wide as long, anterior margin concave, postmandibular lobes slightly pronounced. Pleotelson about twice as long as wide, sides subparallel, caudomedial lobe slightly pronounced.

Antenna 1 reaching about midlength of last segment of peduncle of antenna 2, flagellum with up to about 7 segments, esthete formula 3–0. Mandibles with 4-cuspate incisors and lacinia mobilis; palp with plumose setae in rows on distal segments. Maxilla 1, outer lobe with 13 robust spines, inner lobe with 5 plumose setae.

♂ Pereopod 1, propodus about 1.7× as long as wide, palmar margin elongate, with proximal spine, medial bicuspid process separated by U-shaped cleft from lower, bicuspid distal process; dactyl flexor margin without process, undulating, with small spines. ♀ Pereopod 1, about 2.5× as long as wide, propodus without processes. Pereopod 4 sexual dimorphism apparent, carpus of ♂ about 2.1× as long as wide, ♀ about 2.6×.

♂ Pleopod 1 longer than pleopod 2, protopod very elongate, about equal in length to exopod, with 6–7 retinacula; exopod about 2.3× as long as wide, rounded distal margin with plumose setae, concave lateral margin with short non-plumose setae. Pleopod 2 exopod, proximal segment with 3 lateral setae, distal segment with about 11 long plumose setae along lateral and distal margins, 4 non-plumose setae along mesial margin. Endopod with distinct basal apophysis; tip with 4 processes: (1) caudal process broadly rounded, heavily sclerotized, (2) mesial process broad, subovate, (3) lateral process higher, digitiform, slightly recurved, and (4) cannula obscured by surrounding processes, low, conical. Pleopod 3 exopod distal and distolateral margins with short plumose setae. Pleopod 4 with

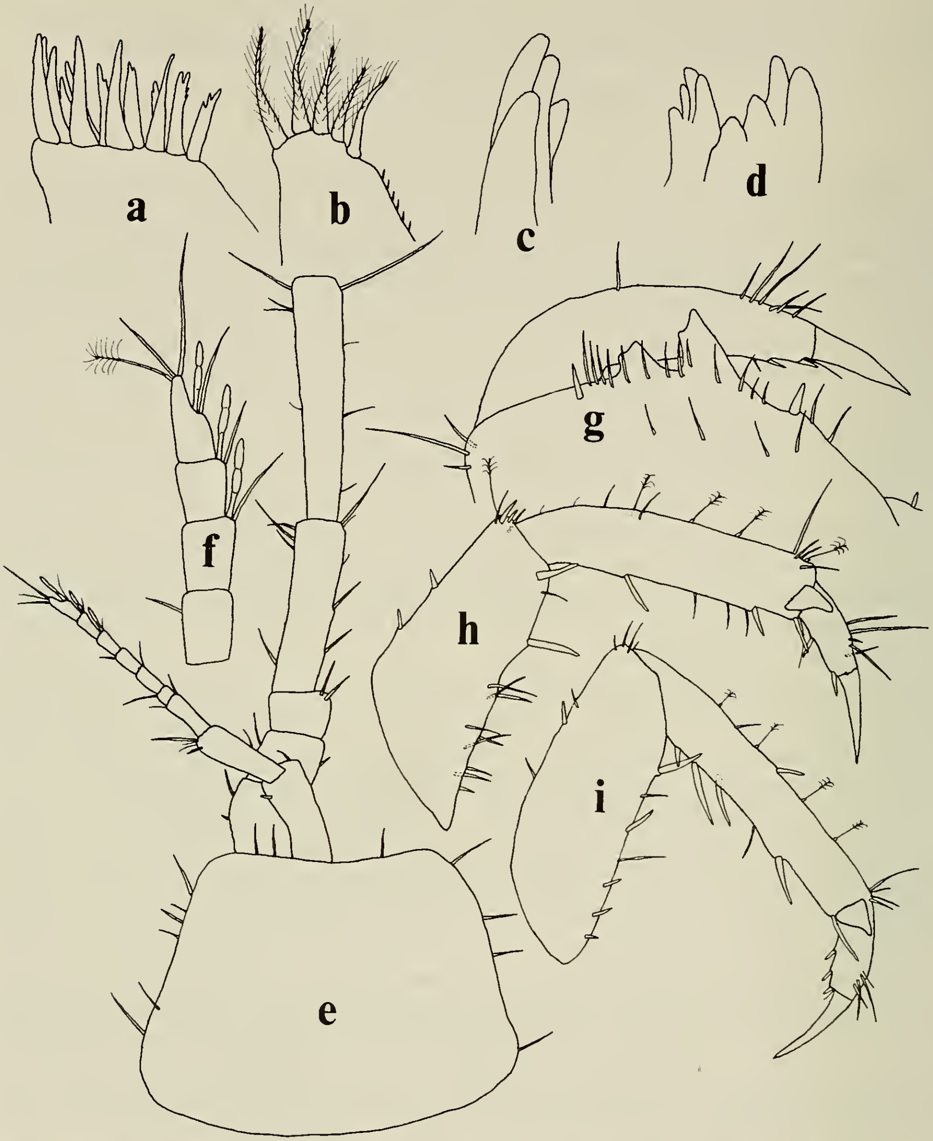

Fig. 1. *Caecidotea phreatica,* ♂ paratype a–h, ♀ paratype i: a, Maxilla 1, outer lobe; b, Same, inner lobe; c, Right mandible, incisor; d, Left mandible, incisor and lacinia; e, Head and antennae; f, Antenna 1, distal segments; g, Pereopod 1, palmar margin of propodus; h,i, Pereopod 4, distal segments.

single sigmoid suture, proximolateral setae present. Pleopod 5 with 2 sutures. Uropods about equal in length to pleotelson in ♂, slightly shorter in ♀.

Etymology.—The name is derived from the Green word *phreatos,* meaning "well" or "reservoir."

Relationships.—*Caecidotea phreatica* shares the general morphology of other members of the Hobbsi Group (Lewis 1982): gnathopod propod armed with well developed processes, first pleopod exopod with plumose setae along distal margin,

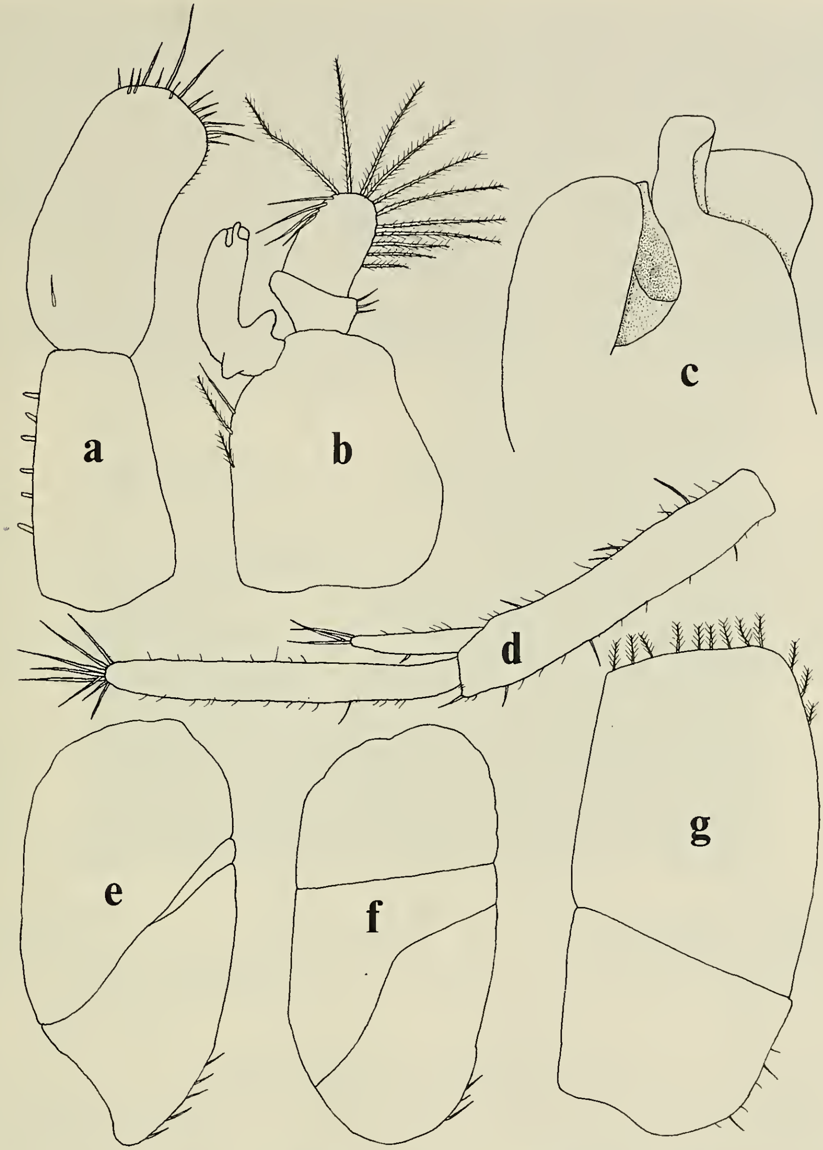

Fig. 2. *Caecidotea phreatica,* ♂ paratype: a, Pleopod 1; b, Pleopod 2; c, Same, endopod tip; d, Uropod; e, Pleopod 4; f, Pleopod 5; g, Pleopod 3.

and second pleopod endopod tip with cannula extending parallel to axis of the endopod, largely obscured by other processes. Otherwise, this species is not geographically or morphologically near other members of the Hobbsi Group.

Distribution and ecology.—To date, *Caecidotea phreatica* has been collected at seven localities in southeastern Virginia (Fig. 4). This species has been collected from a variety of groundwater outlets, including drains (Fig. 4, sites 1, 5, 6, and 7), shallow wells (sites 3 and 4), and a seep-fed pool (site 2). Sites 3–7 occur on the Churchland Flat just east of the Suffolk Scarp and are in the Sedgefield Member

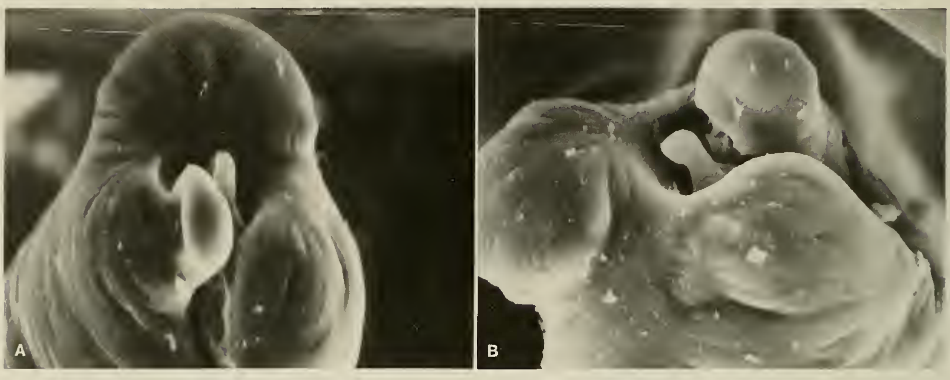

Fig. 3. Scanning electron micrographs of the tip of the endopod of the ♂ second pleopod: A, Anterior aspect; B, Distal aspect. ×1750.

of the Tabb Formation of late Pleistocene age (see Peebles et al. 1984). According to a geological study of this area by Coch (1968), this formation, which was called Sand Bridge in that paper, is composed of marsh and lagoon silty clay, tidal channel clayey sand, and fluvial and lagoon silty sand. Sites 1 and 2 occur on the Isle of Wight Plain just west of the Suffolk Scarp and are in the Windsor Formation of early Pleistocene age. This formation is composed of marine and estuarine

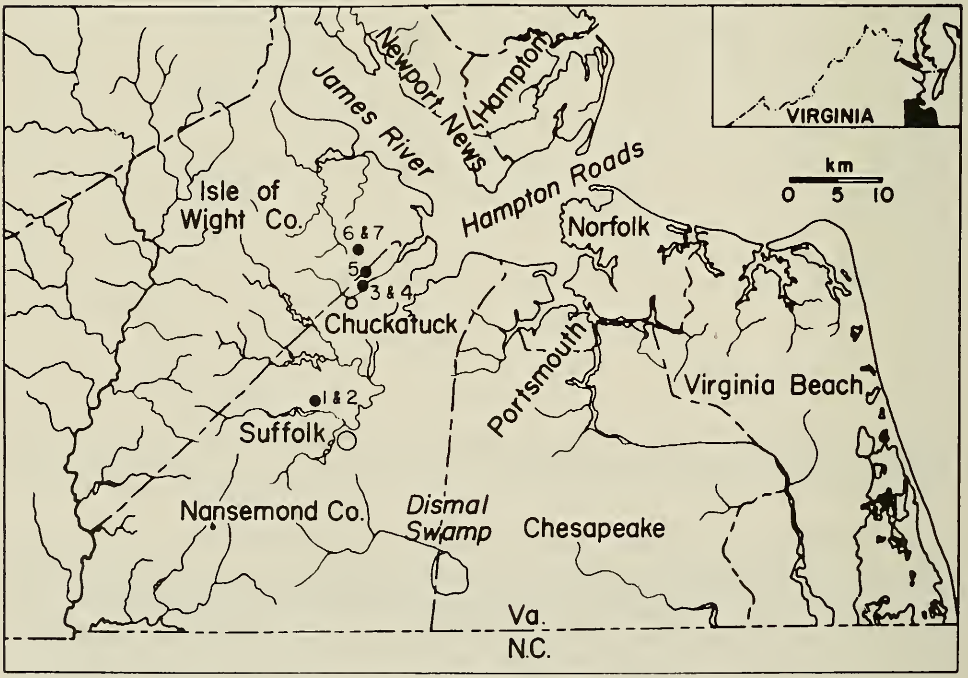

Fig. 4. Distribution of *Caecidotea phreatica* in southeastern Virginia: 1 and 2, Outlet of drain and seep-fed pool, Nansemond Co.; 3 and 4, Shallow wells on Barlow farm, Nansemond Co.; 5, Access well to drain tile on Barlow farm, Nansemond Co.; 6 and 7, Drain pipe outlets on Taylor farm, Isle of Wight Co.

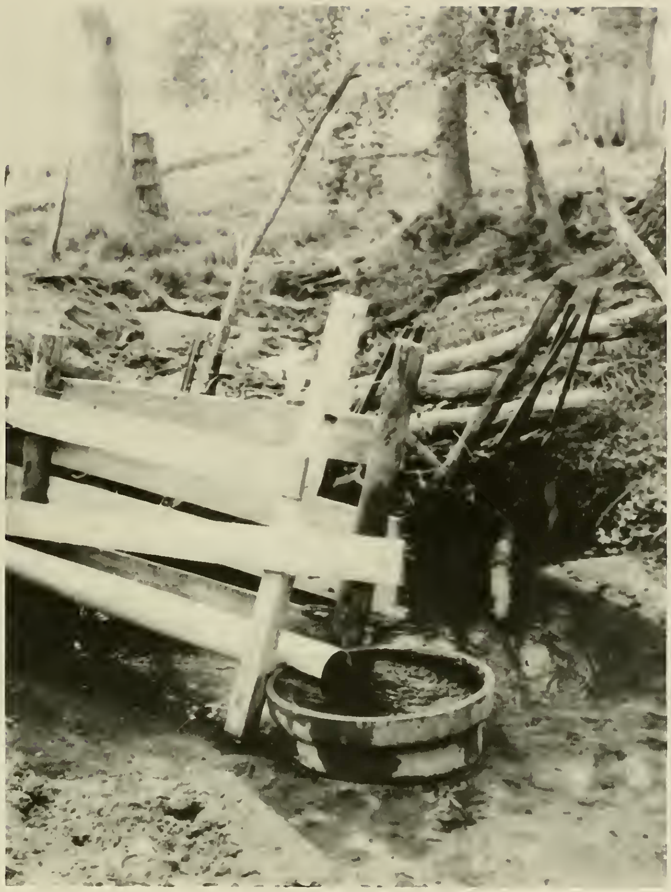

Fig. 5. Outlet of drain pipe (#1) on Taylor farm in Isle of Wight Co., Virginia. Isopods were collected from the basin immediately below the end of the pipe in foreground. The pipe is an outlet for an underground drain tile system beneath the field seen in the background. Photograph from a kodachrome color slide by Holsinger.

sand and silt (Coch 1968). Although the drain outlet visited by Leslie Hubricht in 1945 (Fig. 4, site 1) could not be precisely located during recent fieldwork, it would be near Murphy's Pond and in the Windsor Formation according to the location given on the collection label.

Because *C. phreatica* has been collected from drain outlets, shallow wells, and a seep, we can only speculate on the nature of its natural habitat which is presumably subterranean. All collections have been made from groundwaters that drain areas of unconsolidated sediments of Pleistocene age. In addition, all collections have been made in late winter or early spring at a time when the resurgence of shallow groundwater is usually at a peak. The isopods, as well as the phreatobitic amphipods and flatworms that are sometimes found together with the former (see below), are probably flushed out of their underground habitat by increased flow at this time of year. The subterranean habitat of these phreatobites is believed to be an interstitial medium formed in coarser sediments just beneath the ground water table.

Of particular interest in our observations of *C. phreatica* are the two drain pipe outlets on the Taylor farm (Fig. 4, sites 6 and 7) which open along the bank of a small creek. Groundwater from the pipes flows into ceramic tile, catch basins, which are partly submerged in the creek bed and contain small amounts of organic detritus (Fig. 5). These pipes are the outlets of drain tile systems buried approximately 1.5 m below the surface of adjacent fields. Drain tiles are placed under cultivated fields in agricultural areas with poor natural drainage and are fairly common in certain places on the Coastal Plain in southeastern Virginia.

Collections of isopods were made from the catch basins in March and April 1983, but on a subsequent visit in December 1983, isopods were not found. However, in March 1984, isopods were again observed in the basins. In addition to *C. phreatica,* phreatobitic flatworms, *Sphalloplana hypogea* (Kenk, 1984), and amphipods, *Stygobromus indentatus* (Holsinger, 1967), were collected from the basins. A few epigean invertebrates were also found in small numbers and included oligochaetes, fingernail clams (Sphaeriidae), the amphipods *Crangonyx* spp. (both the *gracilis* and *richmondensis* groups) and *Synurella chamberlaini* (Ellis), and the isopod *Caecidotea forbesi* (Williams).

At other localities, *C. phreatica* was collected with a plankton net from shallow wells on the Barlow farm, and by hand from a woodland pool fed by the seepage of groundwater. Two of these wells are approximately 1.8 m and 4.5 m deep, respectively, and serve as sources of water. The other well provides access to drain tiles and is 1.5 m deep. In the seep-fed pool, *C. phreatica* was found on leaf litter in association with epigean flatworms (*Procotyla* cf. *fluviatilis*) and amphipods (*Crangonyx* sp.—*gracilis* group). The 1945 Hubricht collection of *C. phreatica* from a drain outlet 4.8 km northwest of Suffolk also contained 82 specimens of the phreatobitic amphipod *Stygobromus indentatus* (see Holsinger 1967).

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